GOES-16 AND THE AVIATION WEATHER TESTBED:

INTEGRATING ADVANCED SATELLITE OBSERVATIONS INTO AVIATION WEATHER FORECASTING OPERATIONS

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Testbeds/Proving Grounds workshop
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PAST PROVING GROUND EFFORTS AND GOES-R PROXY PRODUCTS

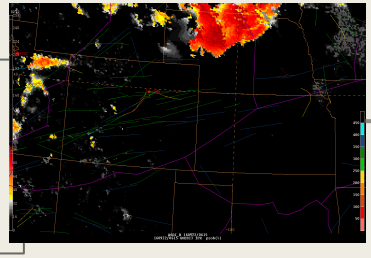
How did readiness levels of GOES-R proxies from 2012-2016 prepare the AWT and AWC for GOES-16 in 2017?

From research to operations…

Aviation operations concern

Is there a way to better identify this hazard?

Question for researchers



Yes… new product created

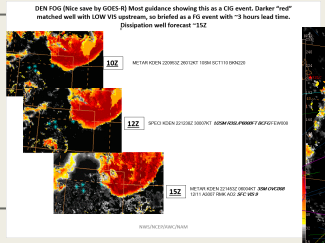
Is this operationally usable? How can it be improved?

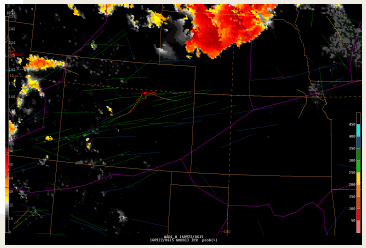
Question for researchers

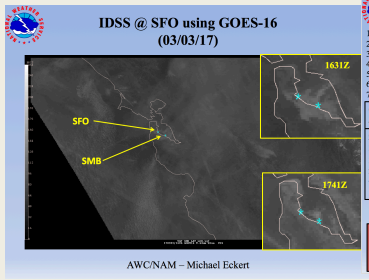
R2O exchange at the Aviation Weather Testbed

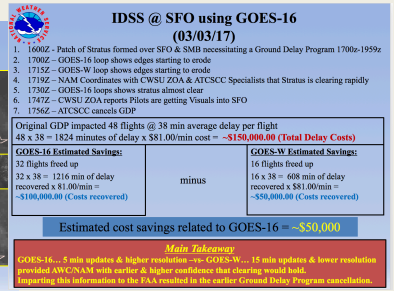
Move to ‘experimental’ operational stage in AWC operations

Real-time operational examples



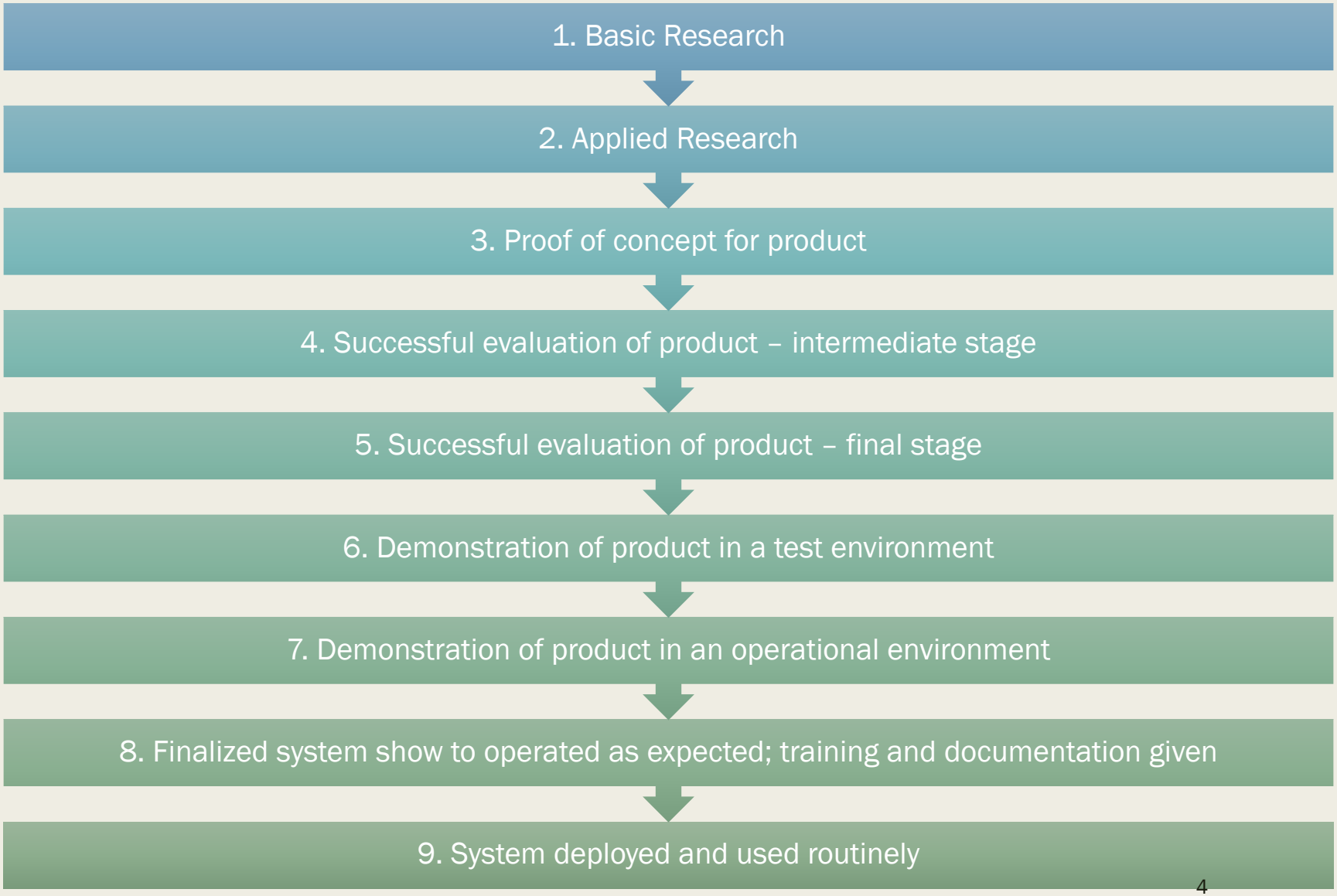


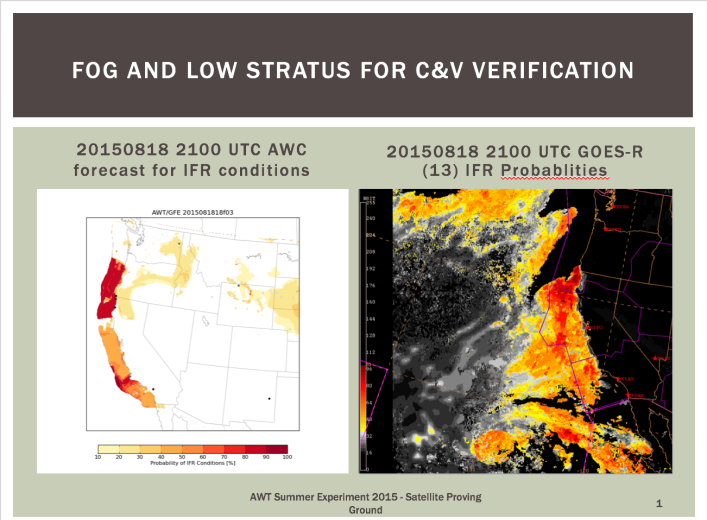


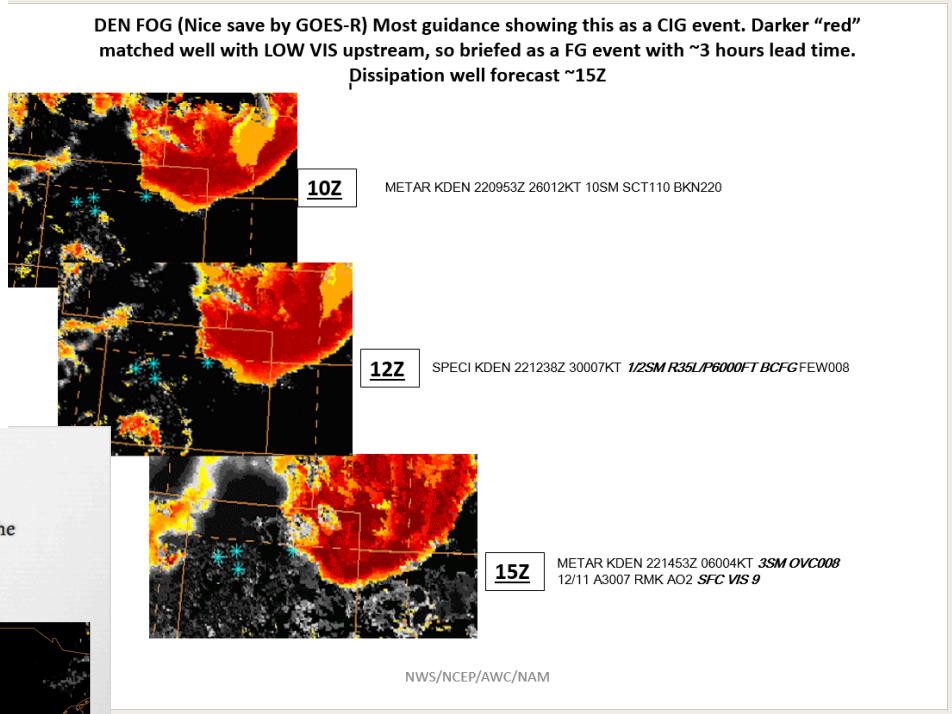


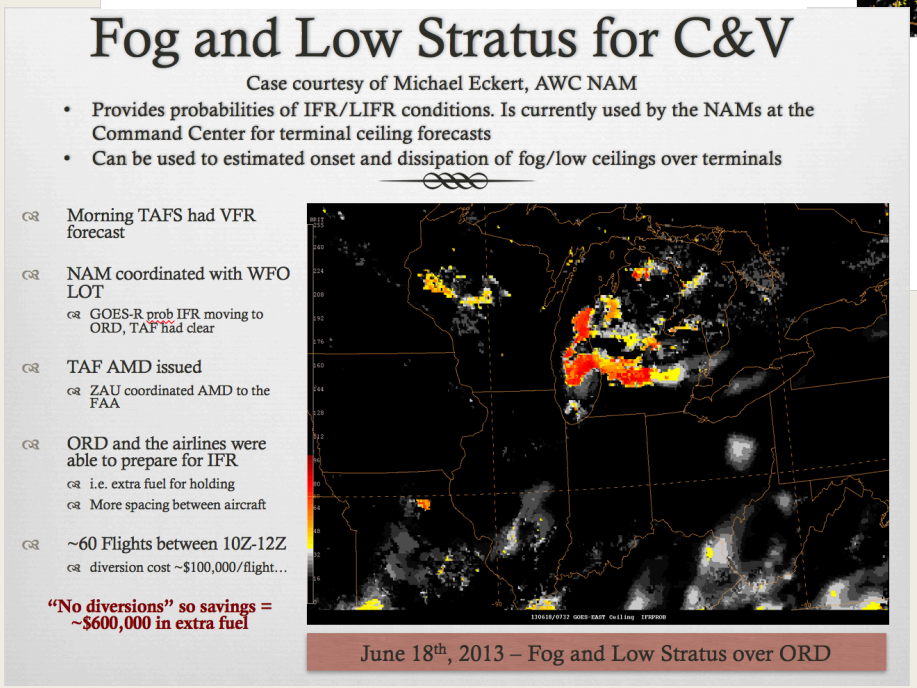
…in the Aviation Weather Testbed

Readiness levels





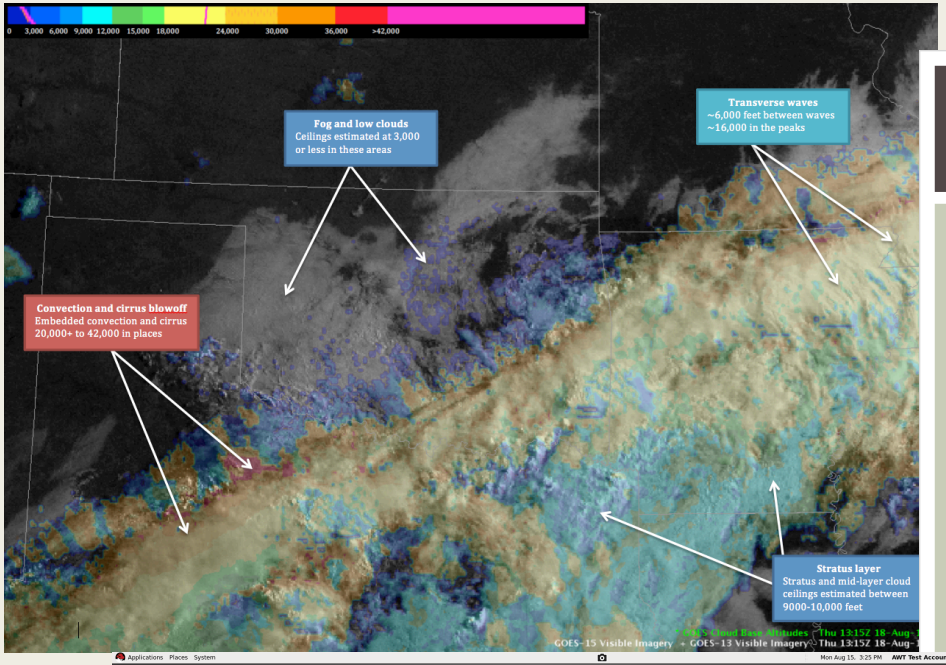




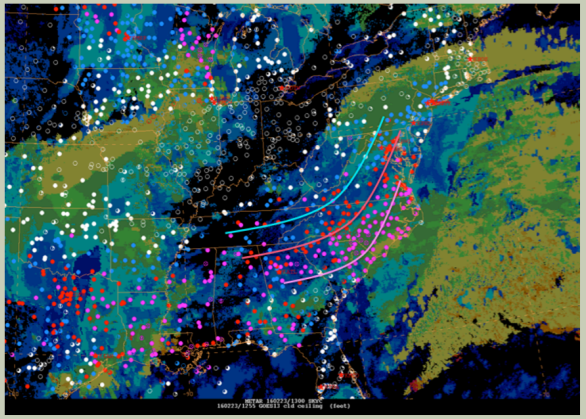
Fog and Low Stratus

9. System deployed and used routinely

3. Proof of concept for product



SATELLITE-DERIVED CEILING HEIGHTS

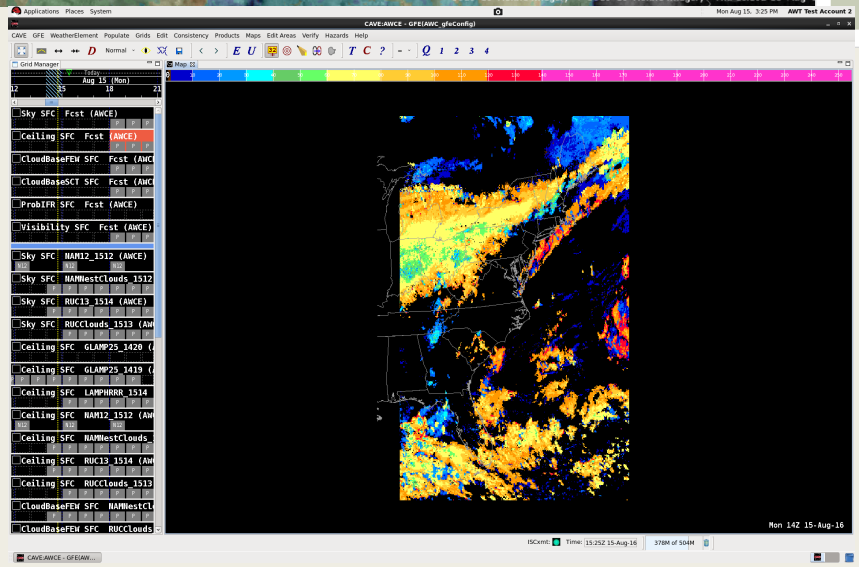


Satellite-derived ceiling heights potential uses:

- Situational awareness in the generation of C&V grids in the Digital Aviation Services effort (TAF issuance, etc.)
- Quick glance at current conditions
- Shows promise in single layer cloud environments but shows struggle with multi-layers

AWT Winter Experiment 2016 - Satellite Proving Ground

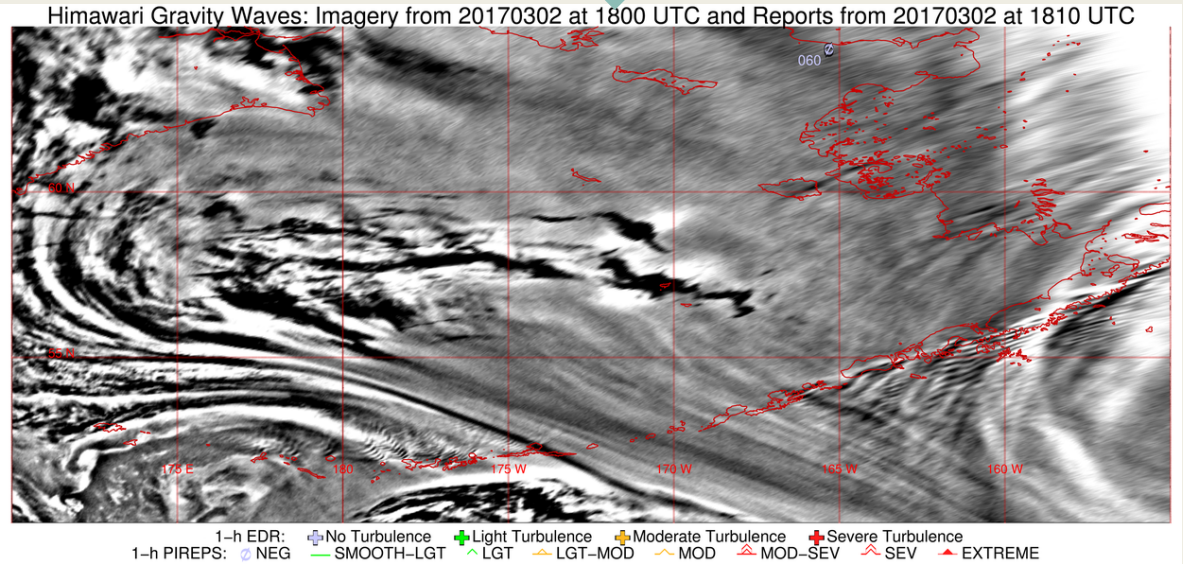
4



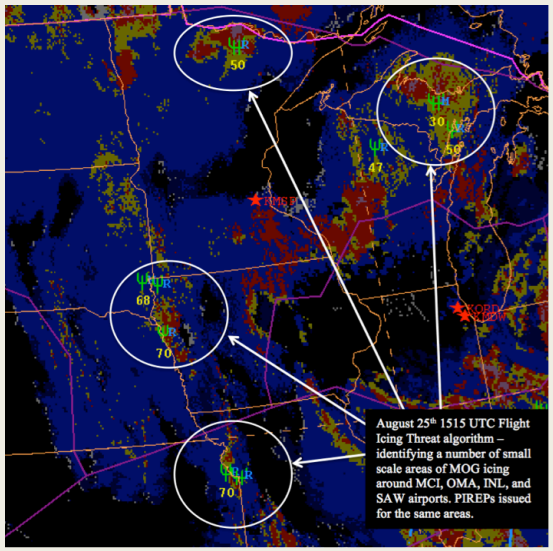
Cloud Base Height and Cloud Cover Layers

Turbulence

4. Successful evaluation of product – intermediate stage



7. Demonstration of product in an operational environment

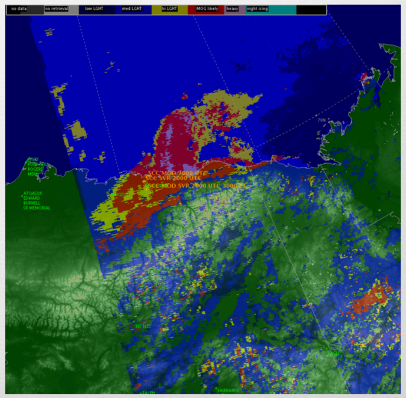


Icing

- The Flight Icing Threat provides a probability and intensity of icing
- Can be used to aid in icing AIRMETs and provide additional icing observations
- Has also been explored for icing forecast verification

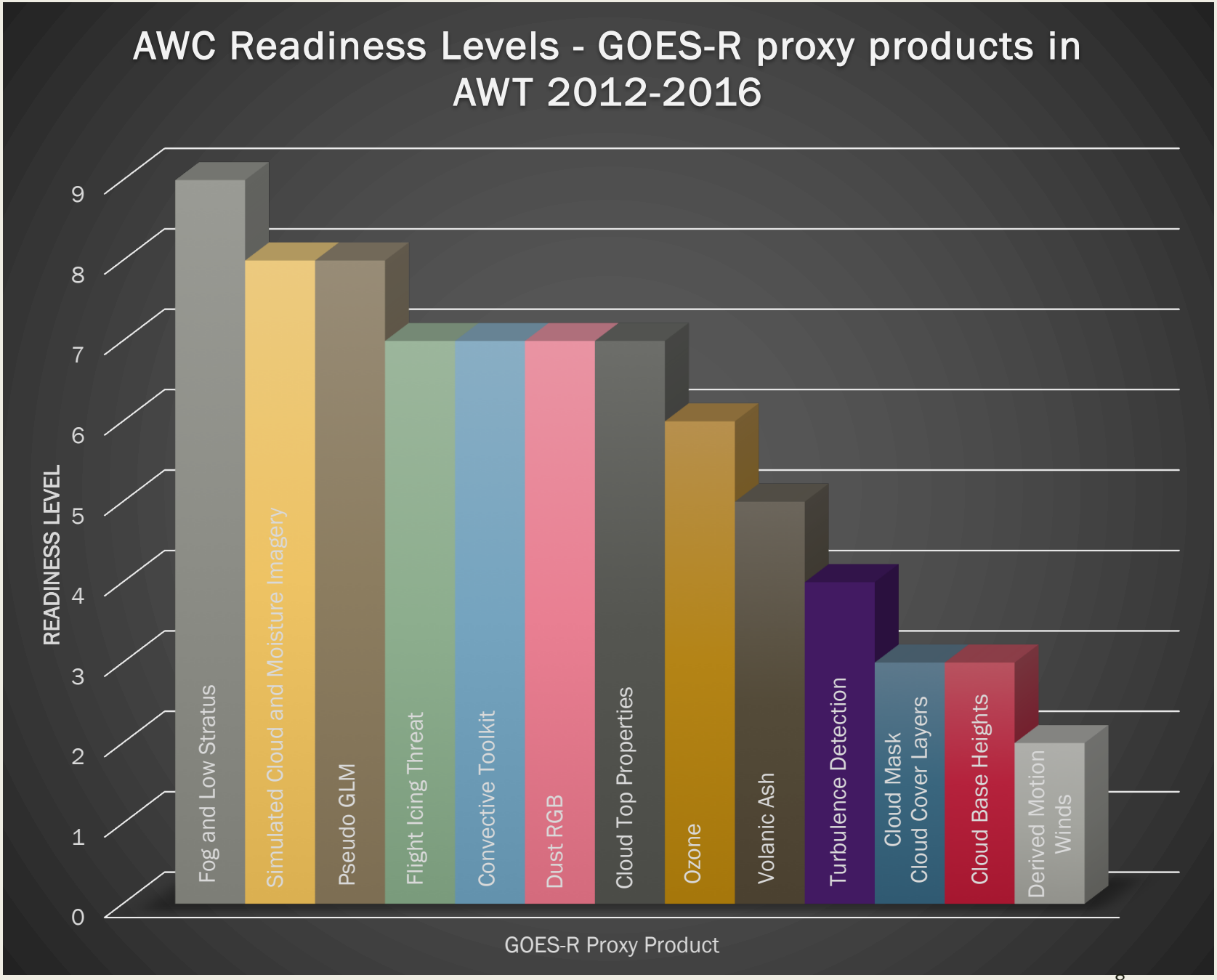
May 6th, 2016

- Severe icing reported in the North Slope over Deadhorse, AK
- Alaska Aviation Weather Unit forecasters used the icing guidance to identify where icing conditions occurred
- Multiple severe and moderate to severe icing reports where issued in and around the airport
- Provided good guidance in an area that rarely has observations of any kind



Icing

AWC Readiness Levels - GOES-R proxy products in AWT 2012-2016



GOES-R PROXIES AND GOES-16 BETA

How did we use the GOES-R proxy readiness levels to identify products for the 2017 beta/provisional GOES-16 evaluations at the AWT?

ABI Baseline Products

Aerosol Detection (Including Smoke and Dust)
Aerosol Optical Depth (AOD)
Clear Sky Masks
Cloud and Moisture Imagery
Cloud Optical Depth
Cloud Particle Size Distribution
Cloud Top Height
Cloud Top Phase
Cloud Top Pressure
Cloud Top Temperature
Derived Motion Winds
Derived Stability Indices
Downward Shortwave Radiation: Surface
Fire/Hot Spot Characterization
Fog/Low Stratus
Geostationary Lightning Detection
Hurricane Intensity Estimation
Land Surface Temperature (Skin)
Legacy Vertical Moisture Profile
Legacy Vertical Temperature Profile
Radiances
Rainfall Rate/QPE
Reflected Shortwave Radiation: TOA
Sea Surface Temperature (Skin)
Snow Cover
Total Precipitable Water
Volcanic Ash: Detection and Height

- Top choices for 2017 demonstration - based on readiness levels reached by proxy GOES-13/15 products at the AWT in previous years
- Secondary choices for 2017 – based on similarity to top choices as well as new products that apply directly to known aviation hazards and forecasting
- Tertiary choices for 2017 – products that may be useful for aviation operations if further explored or used in various models/tools for a specific aviation hazard

GOES-16 baseline products identified for 2017 beta/provisional testing

****Primary focus****

ABI Future Capability Products

Absorbed Shortwave Radiation (Surface)
Aerosol Particle Size
Aircraft Flight Icing Threat
Cloud Ice Water Path
Cloud Heights/Layers
Cloud Liquid Water
Cloud Type
Convective Initiation
Currents
Currents: Offshore
Downward Longwave Radiation (Surface)
Enhanced "V"/Overshooting Top
Flood/Standing Water
Ice Cover
Ozone Total
Probability of Rainfall
Rainfall Total
Sea and Lake Ice: Age
Sea and Lake Ice: Concentration
Sea and Lake Ice: Motion
Snow Depth (Plains)
SO_2 Detection
Surface Albedo
Surface Emissivity
Tropopause Folding Turbulence Prediction
Upward Longwave Radiation (Surface)
Upward Longwave Radiation (TOA)
Vegetation Fraction: Green
Vegetation Index
Visibility

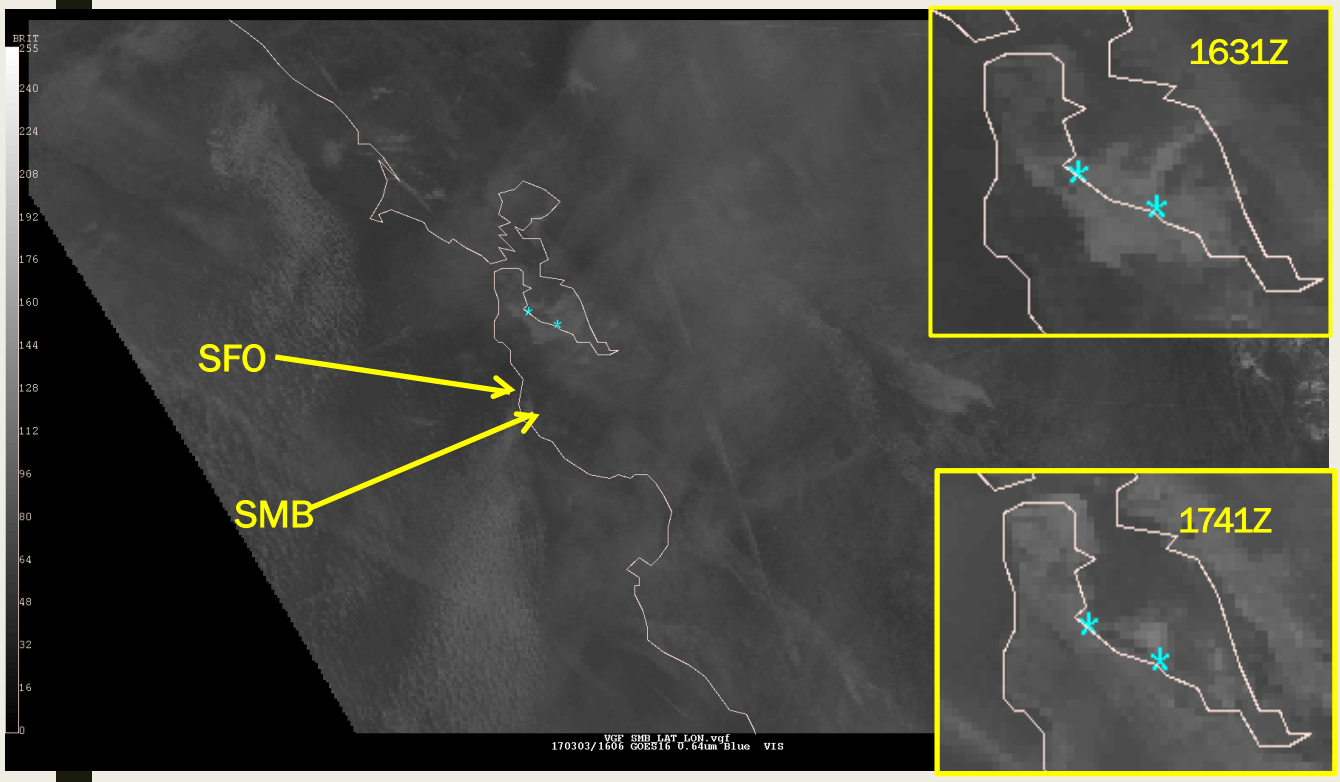
- Top potentials for 2017 demonstration - based on readiness levels reached by proxy GOES-13/15 products at the AWT in previous years
- Secondary potentials – based on similarity to top choices as well as new products that apply directly to known aviation hazards and forecasting
- Tertiary potentials – products that may be useful for aviation operations if further explored or used in various models/tools for a specific aviation hazard

GOES-16 future capabilities products identified for continued testing

****Secondary focus only****

GOES-16 evaluations

IDSS at SFO



AWC/NAM – Michael Eckert

1. 1600Z - Patch of Stratus formed over SFO & SMB necessitating a Ground Delay Program 1700z-1959z
2. 1700Z – GOES-16 loop shows edges starting to erode
3. 1715Z – GOES-W loop shows edges starting to erode
4. 1719Z – NAM Coordinates with CWSU ZOA & ATCSCC Specialists that Stratus is clearing rapidly
5. 1730Z – GOES-16 loops shows stratus almost clear
6. 1747Z – CWSU ZOA reports Pilots are getting Visuals into SFO
7. 1756Z – ATCSCC cancels GDP

GOES-16 evaluations
IDSS at SFO

Original GDP impacted 48 flights @ 38 min average delay per flight
48 x 38 = 1824 minutes of delay x $81.00/min cost = **~$150,000.00 (Total Delay Costs)**

GOES-16 Estimated Savings:
32 flights freed up
32 x 38 = 1216 min of delay recovered x 81.00/min =
~$100,000.00 (Costs recovered)

minus

GOES-W Estimated Savings:
16 flights freed up
16 x 38 = 608 min of delay recovered x $81.00/min =
~$50,000.00 (Costs recovered)

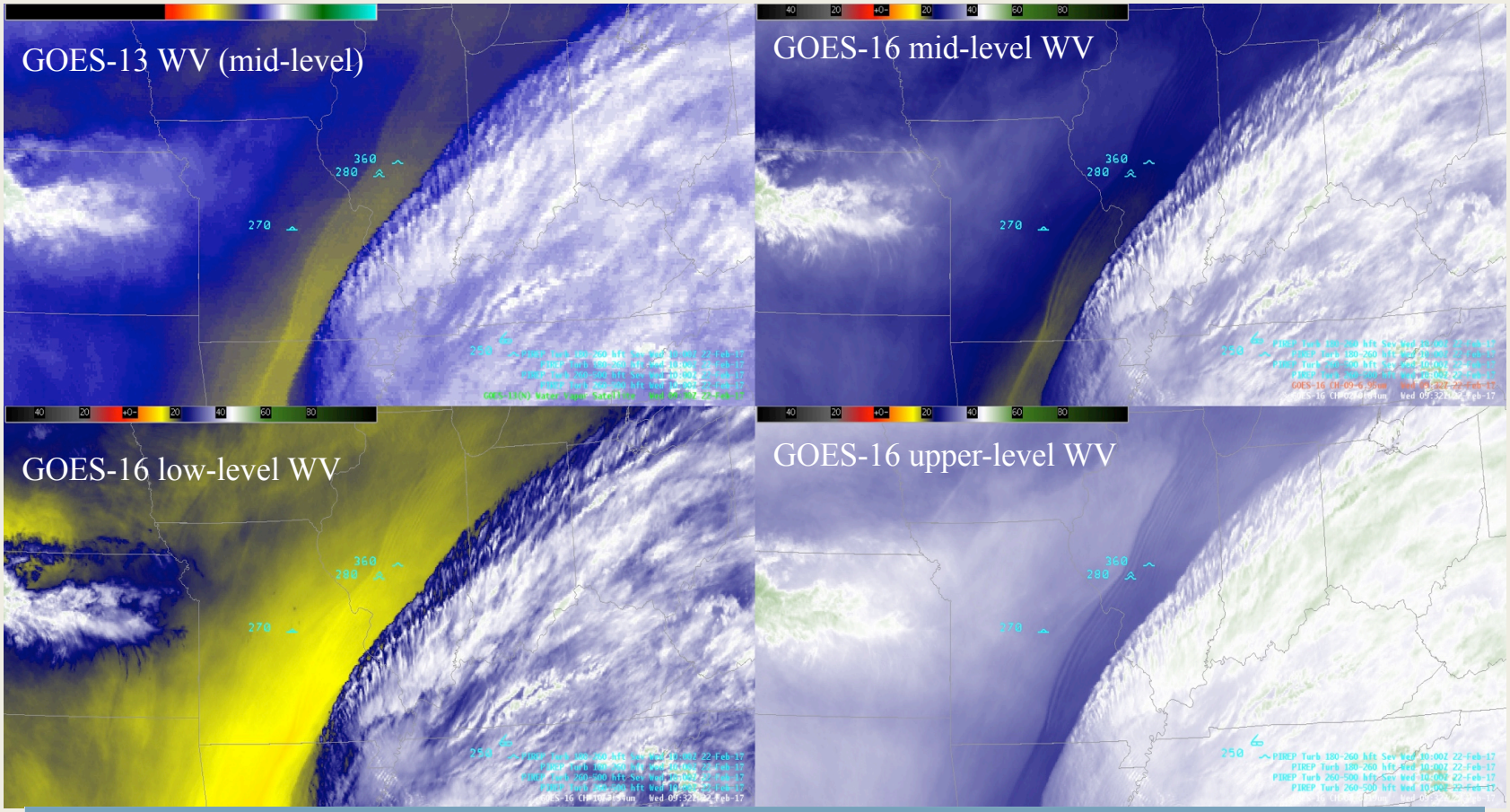
Estimated cost savings related to GOES-16 = ~$50,000

Main Takeaway

GOES-16… 5 min updates & higher resolution –vs- GOES-W… 15 min updates & lower resolution provided AWC/NAM with earlier & higher confidence that clearing would hold.
Imparting this information to the FAA resulted in the earlier Ground Delay Program cancellation.

GOES-16 evaluations

Turbulence

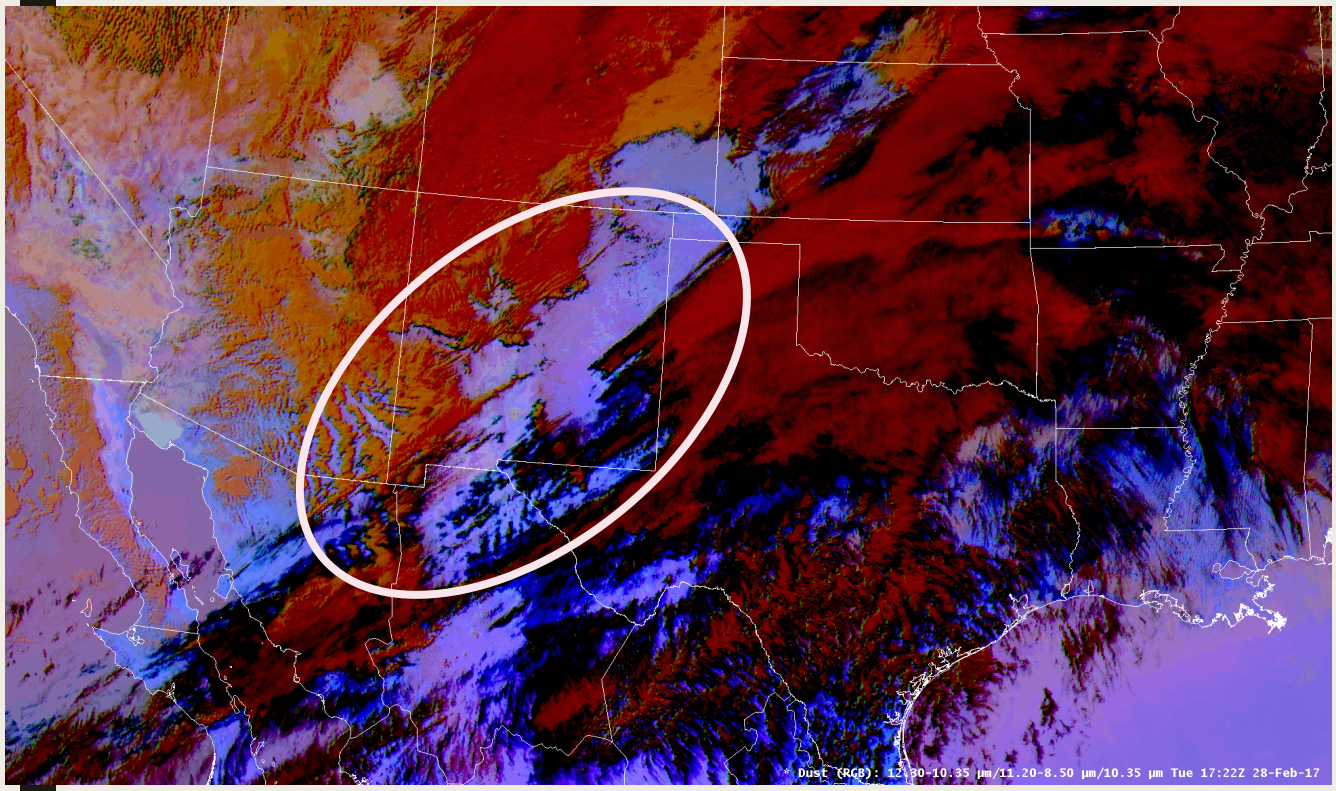


GOES-16 water vapor channels and turbulence identification at AWC

- ***Resolution improvement*** → 2km on G15 to 1km on G16; brings out turbulence features not otherwise visible
- ***Three WV bands*** → The addition of the low and upper-level water vapor bands provides turbulence in more layers of the atmosphere. Is the turbulence layer deep? Narrow? How does the extent differ vertically over a distance?
- ***February 22nd, 2017 932 and 1412 UTC (above)*** → GOES-16 captured wave features and associated widespread turbulence over the Central U.S. that were not readily apparent in GOES-15

GOES-16 evaluations

Dust in SW U.S.

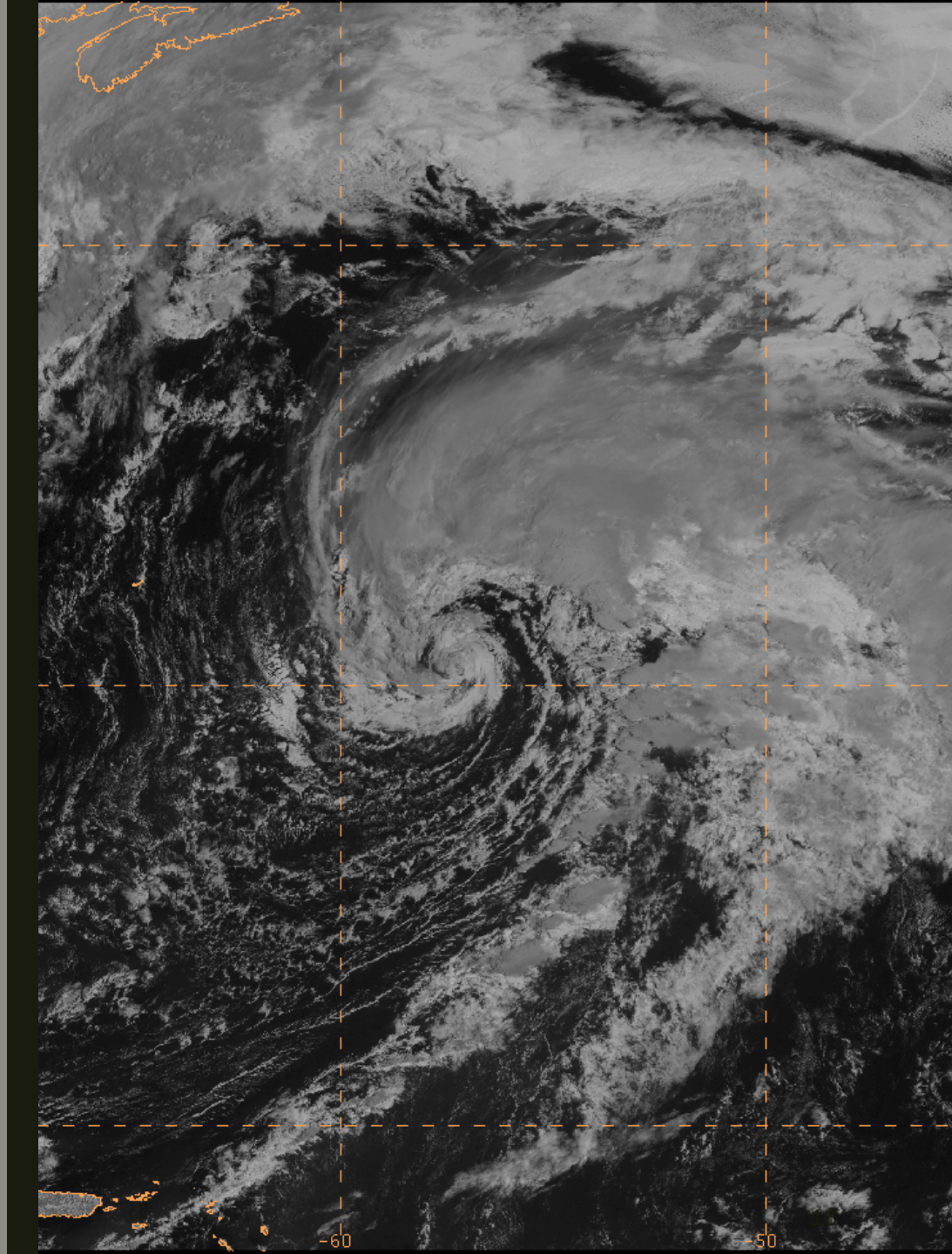


GOES-16 Dust RGB Imagery for blowing dust SIGMET consideration

- *Spectral Resolution* → GOES-16 has additional bands needed to identify and highlight dust, bands not available with the legacy GOES satellite series
- *Spatial Resolution* → 2km resolution along with the RGB capability highlighted dust not visible in generic visible imagery channels
- *Temporal Resolution* → 5-minute imagery revealed a rapidly expanding dust plume in southern NM

Future concepts

- **GLM lightning and the FAA N-90 evaluation** → can GLM lightning benefit traffic flow management and convective IDSS?
- **Cloud/vis properties in the Digital Aviation Services effort** → can various cloud properties and imagery improve the initialization of ceiling forecast?
- **Other** → dust, smoke, volcanic ash detection; water vapor imagery and turbulence; cloud properties and icng



THANKS!

Questions?